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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,694	07/03/2003	Yang-Tung Fan	TS00-776B	7190
7590	06/17/2004		EXAMINER	
George O. Saile 28 Davis Avenue Poughkeepsie, NY 12603			TRINH, MICHAEL MANH	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 06/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/613,694

Applicant(s)

FAN ET AL.

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 9/29/03 (IDS).
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 27-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 27-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 20030929.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

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## DETAILED ACTION

\*\*\* This office action is in response to filing of the application on July 03, 2003. Claims 1-26 were canceled. Claims 27-32 are current pending.

### *Specification & Claim Objection*

1. Claim 27 is objected to because of the following informalities: Claim 27 contains a typing error, in which line 14, "at least on contact pad" should be --at least one contact pad--. . . Appropriate correction is required.
2. The disclosure is objected to because of the following informalities: Specification page 1, information of parent application Serial No 09/950,227 should be updated to include U.S. Patent No. 6,605,524.  
Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 27-28,30-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Greer (6,451,681).

Greer '681 teaches at least one solder bump having been created over the surface of a semiconductor substrate 100 comprising: at least one contact pad (202 in Fig 3; 124 in Fig 6) having been provided on the surface of said substrate; a layer of passivation 300,500 (Figs 3,6) having been deposited over the surface of said substrate, said layer of passivation having been patterned and etched creating at least one opening (Figs 3,6; cols 3-6) through said layer of

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passivation that aligns with said at least one contact pad 202,124 created on the surface of said substrate, exposing the surface of said at least one contact pad 202,124, said layer of passivation 300 having an exposed surface; at least one patterned and etched layer of seed material (e.g. 304 in Fig 3, col 4, lines 16-58; 504/506 in Fig 6, col 5, line 38 through col 6) deposited over the surface of said layer of passivation 300/500, including the exposed surface of said at least one contact pad, said at least one layer of seed material being aligned with said at least one contact pad 202/124; at least one patterned and etched layer (e.g. 308/306 in Fig 3; 604/602/600 in Fig 6) of Under Bump Metal (UBM) created over the surface of said layer 304 of seed material, said least one layer of UBM being aligned with said at least one layer 304 of seed material; at least one layer (310 in Figs 3; 606 in Fig 6) of solder material having a solder height provided over the surface of said at least one layer of UBM, said least one layer of solder being aligned with said at least one layer of UBM; a layer (302 in Fig 3, col 4, lines 30-35; 502 in Fig 6; col 5, lines 56-59) of polyimide coated over the exposed surface of the layer 300/500 of passivation to a polyimide thickness, said polyimide 302/502 thickness being less than said solder 310/606 height by a measurable amount, said solder 310/606 protruding from the surface of said layer of polyimide by said measurable amount, said protrusion forming a protruding layer of solder; said protruding layer of solder having been reflowed, thereby having created a solder ball (Figs 3,6; col 4, lines 59-67). Re claim 28, wherein at least one contact pad layer 202 comprises aluminum or aluminum alloy (col 3, lines 60-63). Re claim 30, wherein the at least one layer of Under Bump Metal (UBM) comprises a layer of chrome, followed by a layer of copper, followed by a layer of gold, created to a total thickness of the layers up to 1.94 micron (Fig 3, col 4, lines 44-58, wherein  $500\text{nm} + 1300\text{nm} + 140\text{nm} = 1940\text{ nm} = 1.94\text{ micron}$ ; and Fig 6, col 6, lines 5-25), wherein, Re claim 29, at least one layer of the under bump metal comprising a layer of nickel (at col 4, lines 52-55), created to a total thickness of the layers up to 1.94 micron (col 4, lines 44-58, wherein  $500\text{nm} + 1300\text{nm}$  (1.3 micron)  $+ 140\text{nm} = 1940\text{ nm} = 1.94\text{ micron}$ ). Re claim 31, wherein the at least one layer of Under Bump Metal (UBM) comprising multiple layers of metal (e.g. 604/602/600 in Fig 6; 308/306 in Fig 3).

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5. Claims 27,28,31 are rejected under 35 U.S.C. 102(e) as being anticipated by Tsuboi (6,528,881).

Tsuboi teaches at least one solder bump having been created over the surface of a semiconductor substrate 11 comprising: at least one contact pad (15, col 4, lines 13-44; Figs 2,18,11-16; col 7, line 60 through col 9) having been provided on the surface of said substrate; a layer of passivation 13 (Figs 2,18) having been deposited over the surface of said substrate, said layer 13 of passivation having been patterned and etched creating at least one opening (Figs 2,12) through said layer of passivation that aligns with said at least one contact pad 15 created on the surface of said substrate, exposing the surface of said at least one contact pad 15 said layer of passivation 13 having an exposed surface; at least one patterned and etched layer 18 (Fig 3, col 4, lines 45-60; and Figs 13,18; col 8, lines 11-65) of barrier seed material deposited over the surface of said layer 13 of passivation (Fig 18), including the exposed surface of said at least on contact pad 15, said at least one layer of seed material being aligned with said at least one contact pad 15; at least one patterned and etched layer 19 (Figs 3,18) of Under Bump Metal (UBM) created over the surface of said layer 18 of barrier seed material, said least one layer 19 of UBM being aligned with said at least one layer 18 of seed material; at least on layer 24 of solder material (Fig 5, col 8, lines 64-67; Fig 18) having a solder height provided over the surface of said at least one layer of UBM, said least one layer 24 of solder being aligned with said at least one layer of UBM; a layer of polyimide (Fig 18,5,2; col 9, lines 50-55; col 4, lines 32-43) coated over the exposed surface of the layer 13 of passivation to a polyimide thickness, said polyimide thickness being less than said solder 24 height by a measurable amount, said solder 24 protruding from the surface of said layer of polyimide by said measurable amount, said protrusion forming a protruding layer of solder; said protruding layer of solder having been reflowed, thereby having created a solder ball (col 8, lines 64-67; Figs 18,5). Re claim 28, wherein at least one contact pad layer 15 comprises aluminum or aluminum alloy (col 4, lines 13-20). Re claim 31, wherein the at least one layer of Under Bump Metal (UBM) comprising multiple layers of metal comprising two metal layers under the solder bump 24 (col 9, lines 62 through col 10 for a copper layer 19 and a nickel layer).

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*Claim Rejections - 35 USC § 103*

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Greer (6,451,681) taken with Moyer et al (6,620,720).

Greer '681 teaches at least one solder bump having been created over the surface of a semiconductor substrate as applied to claims 27-28 and 30-32 above. Re claim 29, Greer also teaches (at col 4, lines 44-58) forming at least one of the under bump metal layers comprising a layer of nickel.

Greer '681 thus already teaches a layer of nickel, but lacks providing a thickness between about 1 and 10 micron.

However, Greer '681 also teaches (at col 4, lines 44-58) creating a thickness of the under-bump metal layers up to 1.94 micron (500nm+1300nm+140nm = 1940 nm = 1.94 micron). Moyer teaches (at col 3, lines 20-56; Figs 2-6B; col 4) forming a solder bump with at least one of the under bump metal layers comprising a layer of nickel, created to a thickness in the range 2000-20000 micron (.2 to 20 micron).

Therefore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to select the portion of the prior art's range of thickness, as taught by Greer '681 and Moyer, which is within and encompassing the range of applicant's claims, because it has been held to be obvious to select a value in a known range by

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optimization for the best results, see In re Aller, et al., 105 USPQ 233; In re Waite 77 USPQ 586 (CCPA 1948); In Re Swanson 56 USPQ 372 (CCPA 1942).

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0956.  
Oacs-8



Michael Trinh  
Primary Examiner